

In the Specification:

Please replace the paragraph beginning on page 1, line 12 with the following amended paragraph:

Liquid crystal display devices are widely used as displays of portable information terminals ~~because of the~~ because of their thinness and lightness and ~~furthermore~~ also because of their small electric power consumption. The liquid crystal display devices require lighting devices because the liquid crystal panels, which are constituent members of the liquid crystal display devices, are not spontaneous luminous elements. The lighting devices are classified in the so-called back light, ~~which~~ light type, in which light is provided on the back surface of a liquid crystal panel, i.e., on the opposite side of a viewer and the so-called front light, ~~which~~ light type, in which light is provided on the front surface of a liquid crystal panel, i.e., on the side of a viewer. The back light is used in the transmittal liquid crystal panels, and the front light is used in the reflective liquid crystal panels. The reflective liquid crystal panels basically require no lighting device, but recently many of the reflective liquid crystal panels have front panels on the front side because the reflective liquid crystal panels are difficult to view in circumstances of little light.

Please replace the paragraph beginning on page 3, line 5 with the following amended paragraph:

The light emitted from a light source, such as a cold cathode tube or others, is usually random polarized light, i.e., non-polarized light, and the light exiting the light guide plate is also random polarized light. The liquid crystal panel usually has a polarizer on the incidence side alone, or on the incidence side and the exit side so that prescribed ~~linear~~ linear polarized light alone enters the liquid crystal panel. That portion of the random polarized light exiting the light guide plate and entering the liquid crystal panel, which actually enters the liquid crystal panel and is used for display is substantially a half of the random polarized light. The utilization efficiency of the light is low. Higher luminance is required for the displays of the portable information terminals.

Please replace the paragraph beginning on page 3, line 20 with the following amended paragraph:

Higher luminance of this prior art structure can be provided by increasing the light emission amount of the light source, such as a cold cathode tube or others. However, this unsuitably increases the electric power ~~consumption~~ consumption, especially for the displays of portable information terminals, etc. driven by batteries.

Please replace the paragraph beginning on page 4, line 5 with the following amended paragraph:

For example, the specification of Japanese Patent Application Unexamined Publication No. Hei 09-73083 (1997) discloses the side light-type lighting device in which a sub-light guide plate, polarization separation means of a cholesteric liquid crystal sheet and phase transforming means of polyvinyl alcohol (PVA) are arranged between a light source and a light guide plate in the stated order from the light source. In this prior art, the polarization separation means of a cholesteric liquid crystal sheet transmits first circularly polarized light and reflects second circularly polarized light, and the phase transforming means transforms the first circularly polarized light into linearly polarized light to make the linearly polarized light incident on the light guide plate. To ~~keep from~~ keep the polarization separation means from being affected by the incident angle dependency, the sub-light ~~guide plate~~ guide plate is provided to make light enter the polarization separation means at the same angle. On the other hand, the reflected second circularly polarized light returns to the side of the light source, is reflected on the surface of the light source, a reflector or others to be circularly polarized light having the polarity reversed, i.e., the first circularly polarized light and is transmitted by the polarization separation means.

Please replace the paragraph beginning on page 5, line 4 with the following amended paragraph:

Accordingly, in the prior art lighting device, more ~~than a~~ than half of the light from the light source ~~can introduced~~ can be introduced into the light guide plate to be used.

Please replace the paragraph beginning on page 5, line 7 with the following amended paragraph:

However, the above-described prior art lighting device requires the assistant member, such as a sub-light guide plate which controls the incident angle of light on the polarization separation means to keep the polarization separation ~~means~~ means, for separating the circularly polarized light from being affected by the incident angle dependency. The above-described reference discloses the structure which does not include such assistant member (the sub-light guide plate), but practically, without the assistant member, the desired effect of improving the utilization efficiency of the light source light cannot be obtained.

Please replace the paragraph beginning on page 5, line 19 with the following amended paragraph:

The above-described prior art has disadvantages that the lighting device ~~has an~~ accordingly large has a large number of ~~members~~ members, and accordingly cannot realize smaller sizes and reduced weights and cannot be fabricated at low costs.

Please replace the paragraph beginning on page 10, line 25 with the following amended paragraph:

Light from the cold cathode tube 12 is generally non-polarized light, and the light reflected on the reflector 14 is also non-polarized. As shown in FIG. 12B, the light emitted from the cold cathode tube 12 exits the light source unit 10, ~~directly or reflected on the reflector 14~~ and is incident on the polarization separation ~~sheet 20~~. sheet 20, directly or after being reflected on the reflector 14. FIG. 12B shows a phase modulation element (a 1/4 wavelength sheet 40) which will be ~~described in embodiments which will be~~ described later.

Please replace the paragraph beginning on page 11, line 8 with the following amended paragraph:

The polarization separation sheet 20 can be a sheet available ~~on market~~, on the market, e.g., D-BEF (trade name) by 3M Co., Inc. The polarization separation sheet 20 transmits linearly polarized light of the light incident thereon, which has a prescribed polarization direction and reflects linearly polarized light of the light incident thereon, whose polarization direction is normal to the prescribed polarization direction. The prescribed polarization direction, i.e., the polarization direction of the transmitted linearly polarized ~~light~~ light, is determined by a direction of the arrangement of the optical axis of the polarization separation sheet. The other linearly polarized light reflected on the polarization separation sheet 20 returns to the light source unit 10. Part of the light propagates to the cold cathode

tube 12, and the rest of the light propagates to the reflector 14. The light incident on the cold cathode tube 12 is used in the secondary emission of the phosphor of the cold cathode tube 12 to be again non-polarized light and is incident on the polarization separation sheet 20. That of the light, which has been linearly polarized in the prescribed direction passes through the polarization separation sheet 20, and the rest of the light, whose polarization direction is normal to the prescribed polarization ~~direction~~ direction, returns again to the light source unit 10.

Please replace the paragraph beginning on page 12, line 15 with the following amended paragraph:

The linearly polarized light which has passed through the polarization separation sheet 20 is incident on the light guide plate 30. The light guide plate 30 is for the front light-type lighting device. As exemplified in FIG. 18, the light guide plate 30 ~~has the~~ has an upper side, i.e., the viewing side of the reflection-type liquid crystal panel including the light guide plate 30 formed in a prism ~~surface of 2~~ surface of two kinds of slant surfaces 32, 34 having inclination angles different from each other, and ~~has the~~ has an underside surface, i.e., the side of the reflection-type liquid crystal panel including the light guide plate 30 formed in a flat surface 36.

Please replace the paragraph beginning on page 13, line 1 with the following amended paragraph:

When the light is incident from the left in FIG. 18, that portion of the light incident on the light guide plate 30, which is incident on the slant surface 32 of the smaller inclination angle propagates through the light guide plate, making total reflections, and that portion of the light incident on the light guide plate 30, which is incident on the slant surface 34 of the larger inclination angle is reflected to exit outside at the underside 36. When the light incident on the light guide plate 30 is linearly polarized, the light is retained linearly polarized in the light guide plate 30, and exits the light guide plate 30, similarly linearly polarized.

Please replace the paragraph beginning on page 14, line 1 with the following amended paragraph:

The structure of the light source unit 50 is detailed in FIG. 13. As shown FIG. 13A, the light source unit 50 comprises a pillar-shaped light guide 52 formed of a transparent member of a substantially square pole, and spot light emitting portions 51 which emit spot light disposed on both ends of the pillar-shaped light guide 52. The spot light emitting portions 51 comprise, e.g., LEDs (Light Emitting Diodes), which are inexpensively available. ~~One of~~ One of the four side surfaces of the pillar-shaped light guide 52 is a flat light

emitting surface 54, ~~and one~~ and the side surface opposed to the light emitting surface 54 is a prism surface 53. ~~The rest~~ The other two side surfaces are flat.

Please replace the paragraph beginning on page 15, line 2 with the following amended paragraph:

Of non-polarized light exiting the pillar-shaped light guide 52, light alone which has been linearly polarized in a prescribed direction by the polarization separation sheet 20 is passed, and as shown in FIG. 16, light linearly polarized in a direction normal to the prescribed direction ~~return~~ returns to the pillar-shaped light guide 52. The light which has returned to the pillar-shaped light guide 52 is incident on the prism surface 53. As shown in FIG. 16A, part of the light is reflected on the reflector 57 to be transformed into non-polarized light and exits ~~again~~ again from the exit surface 54 to be incident on the polarization separation sheet 20. The polarization separation sheet 20 transmits light linearly polarized in the prescribed direction, reflecting the light linearly polarized in the direction normal to the prescribed direction. This process is repeated.

Please replace the paragraph beginning on page 15, line 18 with the following amended paragraph:

Part of the light which has returned to the pillar-shaped light guide 52, as shown in FIG. 16B, is reflected on the reflecting layer 57 and is further totally reflected on

the exit surface 54 to propagate in the pillar-shaped light guide 52 and enters the spot light emitting portion 51. The light is transformed into non-polarized light by the secondary emission and propagates in the pillar-shaped light guide 52 to exit again at the exit surface 54 to enter the polarization separation sheet 20. Then, the polarization separation sheet 20 transmits prescribed linearly polarized light alone and reflects ~~linearly polarized~~ light linearly polarized normal to the prescribed linearly polarized light. This process is repeated.

Please replace the paragraph beginning on page 18, line 9 with the following amended paragraph:

FIG. 21 is a graph of relationships between polarized directions of the linear polarization and angles of the optical axis of the polarizer. Angles of polarized directions of linearly polarized light incident on the polarizer are taken on the horizontal axis. The direction at 90 ~~degree~~- degrees corresponds to the shielding axis of the polarizer, and the direction at 180 ~~degree~~- degrees, i.e., the longitudinal direction of the liquid crystal panel (the longitudinal direction of the linear light source unit) in the present embodiment corresponds to the transmission axis of the polarizer. On the vertical axis are taken extinction ratios, which are ratios of transmitted light quantities of exiting light (transmitted light and reflected light) from the liquid crystal panel to the maximum transmitted light quantity. Based on the graph, it is seen that when a polarized direction of the linearly polarized light agrees substantially with the transmission axis of the polarizer, the transmitted

light quantity is maximum. In other words, when a polarized direction of the linearly polarized light disagrees with the transmission axis of the polarizer, losses due to the absorption in the polarizer take place.

Please replace the paragraph beginning on page 21, line 13 with the following amended paragraph:

FIG. 5 is a view of the liquid crystal display device 150 according to a fourth embodiment of the present invention. The liquid crystal display device 150 is of the transmission-type liquid crystal display device and comprises a transmission-type liquid crystal panel 80, and the lighting device according to the second embodiment described above, which is of the back light-type disposed on the back side of the transmission-type liquid crystal panel 90. The back light-type lighting device according to the present ~~embodiment are~~ embodiment is the same as the lighting device 120 according to the second ~~embodiment in~~ embodiment with respect to the light source unit 50 and the polarization separation sheet 20 but is different from the ~~latter in~~ latter with respect to the light guide plate 80.

Please replace the paragraph beginning on page 22, line 9 with the following amended paragraph:

Accordingly, displays on the liquid crystal panel 90 are viewed ~~directly~~ directly from the front surface of the liquid crystal panel 90. The function of the light guide plate 80 is the same as that of the light guide plate 30 of the above-described embodiments. Light which has been linearly polarized by the light source unit 50 and the polarization separation sheet 20 is incident on the light guide plate 80 and exits the light guide plate 80 retaining its polarization state.

Please replace the paragraph beginning on page 22, line 18 with the following amended paragraph:

As in the embodiment described above, a polarizer is provided on the incidence side (on the side of the back surface) of the liquid crystal panel 90. In the present embodiment as well, the positional directions of the polarization separation sheet 20 and the polarizer on the side of the incidence of the liquid crystal panel 90 are determined so that when linearly polarized light which has passed through the polarization separation ~~sheet 20~~ sheet 20 and enters the polarizer of the liquid crystal panel 90, the polarized direction of the linearly polarized light substantially agrees with the transmission axis of the polarizer.

Please replace the paragraph beginning on page 23, line 4 with the following amended paragraph:

As described above, the liquid crystal display device 150 according to the present embodiment uses the lighting device whose light utilization efficiency ~~is high~~ is high, as does the liquid crystal display device 140 described above, and furthermore, has the light transmission axis of the polarization separation sheet 20 and the transmission axis of the polarizer of the liquid crystal panel 90 which are set so that light from the lighting device can be incident on the liquid crystal panel 90 efficiently without losses, whereby the liquid crystal display device can be bright.

Please replace the paragraph beginning on page 24, line 6 with the following amended paragraph:

In the present embodiment, as shown in FIG. 12B, non-polarized light emitted by the cold cathode tube 12 exits the light source unit 10 directly ~~or reflected on the reflector 14,~~ (or is reflected by the reflector 14), enters and passes through the 1/4 wavelength sheet 40 and is incident on the polarization separation sheet 20. The polarization separation sheet 20 can be a commercially available sheet, e.g., D-BEF (trade name) by 3M Co., Inc.

Please replace the paragraph beginning on page 25, line 4 with the following amended paragraph:

The circularly polarized light which has been incident on the cold cathode tube 12 is used for the secondary emission by the phosphor of the cold cathode tube 12 and exits the light source unit 10 again in non-polarized light. The non-polarized light which has exited the light source unit 10 passes through the $1/4$ wavelength sheet 40, is incident on the polarization separation sheet 20. Only that portion of the light, which has been linearly polarized in the prescribed direction is transmitted, and the rest of the light, which has been linearly polarized normally to the prescribed direction is reflected and again returns to the light source unit 10.

Please replace the paragraph beginning on page 26, line 15 with the following amended paragraph:

In the present embodiment, however, because of the phase modulation element (the $1/4$ wavelength sheet 40) disposed between the light source unit and the polarization separation element (the polarization separation sheet 20), that of the linearly polarized light which has been reflected on the polarization separation element and returned, which is transformed into circularly polarized light by the phase modulation element, reflected on the reflector of the light source unit and is incident again on the phase modulation element is

transformed into linearly polarized light which is transmitted by the polarization separation element. Thus, the linearly polarized light which has been reflected on the polarization separation element and returned can propagate to the light guide plate by returning only once to the light source. The linearly polarized light which has been reflected on the polarization separation element and ~~returned do~~ returned does not have to repeat several times the reflection on and the transmission of the respective elements, and the secondary emission, which lessens losses due to the reflection on and the transmission of the respective elements, and the secondary emission, which leads to higher efficiency of utilizing light.

Please replace the paragraph beginning on page 28, line 8 with the following amended paragraph:

In the present embodiment, as shown in FIG. 17, non-polarized light exiting the pillar-shaped light guide 52 is incident on and passes through the 1/4 wavelength sheet 40. That portion of the light, which has been linearly polarized in a prescribed direction by the polarization separation sheet 20 is transmitted by the polarization separation sheet 20, and only that portion of the light, which has been linearly polarized normally to the prescribed direction returns to the pillar-shaped light guide 52 through the 1/4 wavelength sheet 40.

Please replace the paragraph beginning on page 30, line 2 with the following amended paragraph:

As described above, in the present embodiment as well as in the fifth embodiment described above, the phase modulation element (the 1/4 wavelength sheet 40) is disposed between the light source unit and the polarization separation element (the polarization separation sheet 20). Thus, in the present embodiment as well as the fifth embodiment described above, the linearly polarized light which has been reflected on the polarization separation element and returned can propagate to the light guide plate by returning only once to the light source. The linearly polarized light which has been reflected on the polarization separation element and ~~returned to~~ returned does not have to repeat several times the reflection on and the transmission of the respective elements, and the secondary emission, which lessens losses due to the reflection on and the transmission of the respective elements, and the secondary emission, which leads to higher efficiency of utilizing light.

Please replace the paragraph beginning on page 33, line 5 with the following amended paragraph:

In the liquid crystal display device 200, the direction of the transmission axis of the polarizer disposed on the side of the incidence of the liquid crystal panel 90 is different from that of the embodiments described above. That is, in the liquid crystal display panel of

the embodiments described above, the direction of the transmission axis is in the longitudinal direction of the liquid crystal panel, i.e., in the longitudinal direction of the linear light source unit (the direction indicated by the arrow 24 in FIG. 19A), but in the liquid crystal panel 90 of the present embodiment, the direction of the transmission axis, and the longitudinal direction of the liquid crystal panel, i.e., the longitudinal direction of the linear light source unit 50 form about 45 degree (the direction indicated by the arrow 92 in FIG. 19A). Because liquid crystal panels generally have visual angle dependency, the transmission axes of a pair of polarizers are arranged to intersect each other at a right angle and respectively ~~form 45~~ form a 45 degree angle with respect to the longitudinal direction of the liquid crystal panel.

Please replace the paragraph beginning on page 36, line 14 with the following amended paragraph:

Accordingly, only that portion of light incident on the pillar-shaped light guide 52 from the spot light emitting portions 51, which, as shown in FIG. 15A, is incident on the prism surface 53 under conditions for the total reflection exits at the exit surface 54. Light which, as shown in FIG. 15B, is incident on the prism surface 53 without satisfying the total reflection conditions, and passes through and exits the pillar-shaped light guide 52, or light which, as shown in FIG. 15C, exits once at one prism surface 53 and ~~again enters~~ re-enters the pillar-shaped light guide 52 at another prism surface 53, and propagates through the pillar-shaped light guide 52 to exit at the opposite side does not become light which exits at

the exit surface 54 to propagate toward the $1/2$ wavelength sheet 60 but is light ~~to be~~ that is ineffective.

Please replace the paragraph beginning on page 37, line 3 with the following amended paragraph:

When light is totally reflected, S-polarized component is often increased under a specific angle condition. In the structure of the present embodiment, the angle of the prism surface 53 is set at a specific angle condition, whereby while light repeats incidence and reflection on the prism surface 53, the light in the pillar-shaped light guide 52 has more S-polarized component. Accordingly, the light exiting the pillar-shaped light guide 52 can be linearly polarized light without the use of the polarization separation element. The flat light guide plate ~~30, etc. 30, etc.,~~ included in the above-described ~~embodiments are~~ embodiments, is formed to have ~~conditions for~~ conditions so that the S-polarized ~~component and~~ component and the P-polarized component are totally reflected to the same extent.

Please replace the paragraph beginning on page 37, line 24 with the following amended paragraph:

Accordingly, the lighting device 130 according to the present embodiment is used as the lighting device of the liquid crystal display device 200 according to the present embodiment, whereby the $1/2$ wavelength sheet 60 of the lighting device 130 can function

also as the 1/2 wavelength sheet 100 of the liquid crystal display device 200. The 1/2 wavelength ~~sheet 200~~ sheet 100 can be accordingly omitted. Thus, the use of the lighting device 130 according to the present embodiment can realize bright liquid crystal display devices with smaller numbers of members.

Please replace the paragraph beginning on page 39, line 8 with the following amended paragraph:

The present invention is applicable to lighting devices for applying light to liquid crystal panels, and liquid crystal display devices using the lighting devices. The present invention is useful for lighting devices which can be fabricated at low ~~costs~~ cost and can increase the efficiency of utilizing light source emission thereof with a smaller number of members, and furthermore can increase the luminance of liquid crystal display devices, and liquid crystal display devices using the lighting device.